A New Species of *Xironodrilus* Ellis 1918 from North Carolina (Clitellata: Branchiobdellida)

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ABSTRACT. — *Xironodrilus bashaviae*, new species, is described from the crayfish *Cambarus bartonii* collected at several sites in the upper drainage of the Yadkin River, Forsyth County, North Carolina. It is the only species of the genus known to occur east of the Blue Ridge Mountains. The new species differs from other members of the genus primarily in details of the reproductive system and dental formula.

None of the known species of the genus *Xironodrilus* Ellis 1918 has been adequately described in published work. The discovery of a new species outside the recorded range of the genus (Holt 1969) and the work of one of us (W.) on the ultrastructure of this form affords us a propitious opportunity to present a description of this newly found species.

The literature pertaining to *Xironodrilus* is exceedingly sparse. Moore (1894) recognized as *Branchiobdella pulcherrima* the first species now assigned to the genus. Ellis (1919) formally erected the genus and more fully described a species, *X. formosus*, which had been proposed in an earlier paper (Ellis 1918). The effective date for both the erection of the genus and the naming of its type-species (*X. formosus*) must derive from this earlier work. There are other incidental references and some incomplete, but valid, species designations in the literature which will be cited below, but the only detailed treatment of the genus is contained in Holt's (1951) unpublished dissertation.

Our methods are those long used by Holt (1960 *et seq.*). Serial sections were prepared by Weigl using material fixed in 70% ethanol and stained with Harris' hematoxylin and eosin. The drawings (by H.) were done with the aid of a camera lucida; all structures are illustrated with their anterior

to the reader's right; cross-hatching indicates muscular and stippling, primarily, glandular tissues. Measurements are approximations done with an ocular micrometer and where averages are given the minimal and maximal measurements taken are enclosed in parentheses. The scanning electron micrograph was photographed by Weigl.

Genus *Xironodrilus* Ellis 1918

Type-species: — *Xironodrilus formosus* Ellis 1918, by subsequent designation (Ellis 1919).

Diagnosis: — Body depressed widening gradually from segment I to segment VII; deferent ducts entering ental end of spermiducal gland; prostate absent; bursa spherical; penis protrusible (modified from Hobbs et al. 1967).

Remarks: — Members of the genus are distinguished from those of *Xironogiton* Ellis 1919, and *Ankyrodrilus* Holt 1965, the only other American branchiobdellids with a flattened ("depressed") body form, by the ental entry of the vasa deferentia into the spermiducal gland. The species of *Xironodrilus* are known from the Blue Ridge Province of the Appalachians and the Interior Low Plateaus into the glaciated regions of Michigan (Holt 1969): the species described herein is the only one known from the Piedmont of the Appalachians east of the Blue Ridge Mountains.

Xironodrilus bashaviae, new species
Figures 1 and 2

Type-specimens: — Holotype, USNM 53641 taken on *Cambarus bartonii* from Hunter's Creek, 0.8 km from the intersection of State Routes 1463 and 1446, Forsyth County, North Carolina, by Ann M. Weigl, 9 September 1975 (PCH 3376; AW 21 A); three paratypes (PCH 3376) in the VPI & SU Center for Systematics Collections; three paratypes (AW 21 C) in the collections of Ann Weigl.

Diagnosis: — Medium large branchiobdellids (average length about 3.5 mm); dental formula 4/4, lateral teeth of each jaw longer than median ones; bursa subspherical; ejaculatory duct long, thick, curving laterodorsad from bursa; spermiducal gland large, with prominent lumen; spermathecal duct long, bulb long, subcylindrical.

Etymology: — For Bashavia Creek, of which Hunter's Creek is a tributary.

Description: — Specimens of *Xironodrilus bashaviae* are large, but not among the largest, branchiobdellids, averaging about 3.5 mm in length (pre-

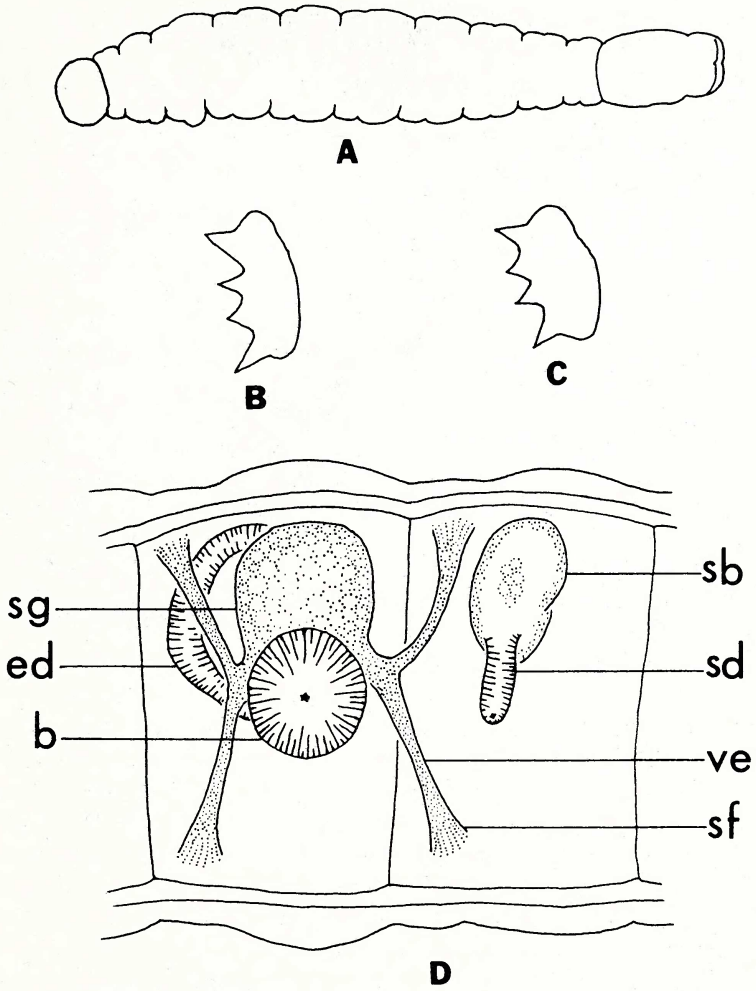

Fig. 1. Structural details of *Xironodrilus bashaviae* new species. A, ventral view of holotype; B, upper jaw; C, lower jaw of paratype; D, reproductive systems in ventral view. Abbreviations: *b*, bursa; *ed*, ejaculatory duct; *sb*, spermathecal bulb; *sd*, spermathecal ectal duct; *sf*, sperm funnel; *sg*, spermiducal gland; *ve*, vas efferens.

served material). The holotype (selected for the clarity with which internal structures may be seen) has the following dimensions: *total length*, 2.8 mm; *greatest diameter*, 0.6 mm; *head length*, 0.6 mm; *head diameter*, 0.4 mm; *diameter, segment I*, 0.3 mm; *diameter, sucker*, 0.4 mm. The average dimensions, with minima and maxima given in parentheses, of the holotype and four specimens selected at random from the type-series are as follows: *total*

Fig. 2. Scanning electron micrograph of a portion of the body of *X. bashaviae*. Note ciliary tufts.

length, 3.4 mm (3.4-4.2 mm); *greatest diameter*, 0.8 mm (0.6-1.2mm); *head length*, 0.7 mm (0.6-0.8 mm); *head diameter*, 0.5 mm (0.4-0.6 mm); *diameter, segment I*, 0.4 mm (0.3-0.5 mm); *diameter, sucker*, 0.5 mm (0.4-0.5 mm). In the holotype and one paratype, segment V was greater in diameter than segment VII. The latter, which bears the ovaries and developing eggs, is normally greater in diameter among all members of the order. In these two specimens there are no large eggs.

Scanning and transmission electron microscopy of *X. bashaviae* have revealed the presence on the outer epithelium of numerous bristle-like structures, each composed of a tuft of cilia. The tufts are most abundant in the region of the mouth, but are also found on other parts of the head as well as on the body segments (Fig. 2). They are not visible by light microscopy, though "sensory" hairs have been detected in the mouth region of other branchiobdellids (Franzen 1963:370; Moore 1895:499; Holt, unpub. observ.).

The animals widen uniformly from segment I to their greatest diameter in segments VI and VII and from there become narrower towards the sucker and are uniformly, but not excessively, flattened, except for the terete head. The posterior annulus of each segment is only slightly less in

diameter than the anterior one, conferring a generally smooth appearance to the outline of the body.

There is a pronounced external sulcus or constriction of the head immediately posterior to the position of the jaws. No other external evidence of the segmentation of the head is apparent. Both upper and lower lips bear very shallow and narrow emarginations. Oral papillae are not detectable in our specimens. There is one internal pharyngeal sulcus, deep, and closely compressed, delimiting the posterior 1/3 of the head region from the anterior 2/3.

The jaws are subequal in size, their width about 1/8 the greatest diameter of the head. They consist of subquadrangular plates carrying prominent teeth-bearing ridges. The dental formula is 4/4 and the lateral teeth are longer than the median ones and often noticeably diverge laterad. The teeth may be blunted, particularly the median ones, presumably by wear. The jaws are brown; the teeth colorless.

The sperm funnels are narrow; not conspicuously set off from the vasa efferentia by constrictions. The vasa deferentia are short and thick, entering the ental borders of the spermiducal gland at widely separated portions of its ventral surface.

The spermiducal gland is short and thick and roughly subspherical. Its ventral (ental) border lies just dorsal and to the side of the bursa; its dorsal border extends to about the mid-portion of its segment. Its most distinctive feature, aside from shape, is the capaciousness of its lumen (obscure in most branchiobdellids) which is expanded so that it appears as a thin-walled sac filled with a clear fluid. Moreover, again unusual, there are small amounts of spermatozoa clustered in the central portion. The wall of the spermiducal gland is, however, composed of the usual elements (Holt 1949) of a peritoneal investiture, a thin muscular covering and a lining of glandular epithelium.

The ejaculatory duct is a long and prominent tube composed of the usual layers of muscle. The bursa is small and subspherical, in diameter about 3/4 that of the segment (VI) in which it lies. There is a short ectal (outlet), narrowed portion and the penis is a simple, protrusible, muscular cone, exserted, one presumes, by the eversion of the bursa.

The spermatheca has a relatively long ectal duct and the cylindrical bulb bends dorsad between the gut and the body wall. The curvature of the organ precludes, in the absence of tedious and essentially impossible procedures, any just estimate of its length.

Variation: — Beyond the usual differences in size and those produced by differing degrees of contraction at death, there are few variations of note. The relative lengths of the teeth seem to differ, but the lateral teeth are

always at least as long as the median ones and usually longer. There is a possibility that the dental formula may vary slightly, but it is constant for all the specimens examined in which it could be determined.

Affinities: — In the true sense of the word, until there is a monographic revision of the genus, the affinities of *X. bashaviae* cannot be determined. *Xironodrilus formosus* has a small spermiducal gland without the expanded lumen of *X bashaviae* and lacks an ejaculatory duct. The dental formulas also differ: that of *X. formosus* varies from 4/3 to 6/5 (Holt 1951). *Xironodrilus pulcherrimus* (Moore 1894) has a dental formula of 3/3 with the middle tooth shorter than the lateral ones and its spermiducal gland is slender and lacks the expanded lumen of *X. bashaviae*. In addition, specimens of *X. pulcherrimus* (Moore 1894; Holt 1951) are somewhat larger than any of those of *X. bashaviae* we have measured. *Xironodrilus appalachius* Goodnight 1943 also has a dental formula of 3/3 with the middle tooth longer than the lateral ones and a reproductive system similar to that of *X. pulcherrimus*. Specimens of *X. appalachius* are of approximately the same size as those of *X. bashaviae* (Holt 1951). *Xironodrilus dentatus* Goodnight 1940 is characterized by a dental formula of 4/5, 5/5 or 5/4 and is recorded from Oklahoma and Missouri. The jaw shape and other features of this species also differ from *X. bashaviae* (Holt, unpub. data).

Host: — *Cambarus bartonii* (Fabricius 1798).

Distribution: — The type-locality, two sites in Bashavia Creek and one in Fries Creek, are all part of the upper drainage of the Yadkin River in Forsyth County, North Carolina.

Material examined: — The type-series and 38 other specimens mounted entire and portions of several serially sectioned animals.

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